NDE OF COMPOSITE MATERIALS USING REMOTE HEALTH MONITORING TECHNIQUES

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ABSTRACT

The assurance of the durability and performance of composite structures requires NDE monitoring their integrity at the various stages of their life, from manufacturing through service. In the last three decades many NDE methods were developed either by modifying the technology that was used for ND] : of metals or by specificall y addressing the unique characteristics of these materials, This development was made in parallel to the application of composites to both flaw critical structures (aircraft wings, fuselage, etc.) and to commercial products (rackets, fishing rods, etc.). In spite of the significant progress that was made several problem areas and critical needs arc still exist as listed below:

- Process standards arc strict, limited and arc not consistent industry wide.
- No practical residual stress measurement techniques arc available.
- There is a need for large-area rapid-scanning techniques.
- '1'here is a need for efficient health (in-process and in-service) monitoring techniques.

While in metals, an inspection schedule can bc acceptable due to the ability to predict accurately flaw growth, the random nature of impact damage to composites the risk associated with such damage arc requiring more frequent inspections. Service defects that arc detected only after they grew to a substantial size can cause costly repair and impose high risk to the users' life. Further, flaws that arc detected during production may bc eliminated or enable to introduce corrective measure and thus save significant y in cost of manufacturing.

The need for detecting flaws at early stages without disassembly arc feasible using remote interrogation or embedded sensors. Such methods rapidly gaining interest as the development of both laser based ND] : methods and sensors are growing. Some of these NDE methods are covered by other speakers including shearography and laser ultrasonics as well as the use of embedded optical-fiber. The emphasis of this presentation will be on the application of sensors for health monitoring The evolution of microelectronics and sensor technology particularly the recent growth in MEMS (micro electromechanical systems) technology have led to the availability of powerful health monitoring. tools. Neural networks and expert systems arc incorporated to assist in the characterization of flaws and the decision making regarding to flaws critically to the serviceability of the test structures. information about the health of structures can bc obtained at any desirable moment at high reliability and low cost.